DOCUMENT REVIEW: DRAFT FINAL, PHASE III RFI/RI REPORT,
ROCKY FLATS PLANT 881 HILLSIDE (OPERABLE UNIT NO 1)
OCTOBER 1992

MAJOR CONCERNS

1 Methods of determining background and making comparisons to background are inconsistent among the main body of the RFI/RI Report, the Public Health Evaluation (PHE) and the Environmental Evaluation (EE) In addition, the methods are flawed

The main body of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI/RI) Report and the PHE (Vol XIV) use different approaches to define background for inorganics and radionuclides and different methods to compare metal and radionuclide concentrations to background The approaches used in the EE are not clearly defined but do not appear to correspond exactly to those used in either the RFI/RI Report or the PHE The different definitions and comparisons lead to different conclusions about which inorganics and radionuclides occur at levels above background For example, the human health risk assessment concludes that concentrations for all metals are below background (Vol XIV, Table 2 3) while the RFI/RI Report concludes that several metals occur above background (RFI/RI Report, Figs 4-84 and 4 95) A consistent definition of background and a consistent comparison method should be used throughout the report leading to a single list of inorganics and radionuclides that appear to occur at levels above background In addition, as detailed below and in the general comments on the PHE, much of the background methodology appears to be flawed

In the main body of the RFI/RI Report, the use and definition of background is poorly presented The RFI/RI Report appears to rely on the 95th percent tolerance level for inorganics and radionuclides, and detection level for organics, with an additional range of an order of magnitude (or ten times?) beyond that value The document should clarify what value is being used as the number which if exceeded, will result in additional analyses The most conservative of the approaches currently used would be that any value above the 95th percent tolerance level would undergo additional analysis The approach used in this report, expanding the range above the 95th percent level, should be presented as a separate section with the supporting rationale Also, it should be clearly stated if an order of magnitude is being used or 10 times the value We note, however, that the use of the tolerance interval to define background is itself questionable and not in fact conservative because it will result in higher background limits for poor background data sets

2 The report commonly dismisses organic contamination as being the result of laboratory" contamination This dismissal appears to be a wide-spread problem affecting all sample sites and media To support the conclusion that this is a laboratory problem, the quality control (QC) data should be presented as a separate section The purpose of those samples was to determine whether incidental contamination was taking place and an analysis of this information would support the arguments presented in this study

GENERAL COMMENTS

1 The use and definition of "background" is not clearly justified The report first defines and discusses upper 95 percent tolerance levels for natural, background inorganic analytes and radionuclides These levels are meant to be used to discern natural, geochemical background concentrations at the Individual Hazardous Substance Sites (IHSSs) from anthropogenic contamination It is common practice in the regulated community to use tolerance intervals as a screening tool to exclude inorganic analytes from risk assessment considerations or comparisons with Maximum Contaminant Levels [e g , *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, U S Environmental Protection Agency (EPA), 1989] and health-based action levels (i e , proposed Subpart S of RCRA) This report proposes to characterize the concentration (or activity) of any inorganic analyte as natural, geochemical background, if the concentration (activity) is the same order of magnitude as the estimated upper 95 percent tolerance level Although this may be a reasonable exercise, it is not a common practice It is therefore recommended that the text devote a section to developing a scientifically and statistically based justification for the use of "the same order of magnitude as the upper 95 percent confidence interval" as the definition of natural, geochemical background

2 Considerable confusion exists in the expression and discussion of Rocky Flats geology The boundaries between the Rocky Flats Alluvium (RFA), colluvium, and artificial fill materials have been shown only on the surface in many cross sections, and there is no information about their subsurface extensions Also, in some cross sections (e g Fig 3 13), lithologic boundaries extend from one phase "area" into another Logically it is difficult to imagine how a lithologic unit can continue from colluvium into artificial fill It raises the question about how the geologic boundaries are identified in the field Geologic descriptions in the text do not give the answer Also, most lithologic boundaries in the cross sections are horizontal except for those controlled by more than one borehole The well-controlled boundaries indicate that most lithologic boundaries in the Rocky Flats Alluvium are not always horizontal The horizontal expression of the lithologic boundaries is especially inadequate in the sections with exaggerated vertical scales The concept of horizontal bedding should be reviewed

3 Based on the descriptions in the Phase I and Phase III reports, there are two different kinds of "slumps" at OU 1 one is caused by landslides and can be identified on aerial photographs, and the other is probably formed by soft sediment deformation (Rockwell International, 1988, OU 1 *Phase I Report* Vol I) The two types of slumping have not been well differentiated in the description in this Phase III report, and the extent and significance of each in terms of their roles in contaminant transport have not been discussed

4 It is recommended that the lower Hydrostratigraphic Unit (HSU) be shown in the conceptual model (Figs 5 14 and 5 15) for two reasons 1) a possibility exists that contaminants migrate from IHSS 119 1 to the lower HSU as discussed in Sect 5 3 1 2, and 2) upper HSU may be discontinuous and locally connected with the lower HSU, as revealed by the pumping test data from neighboring OU 2 area

SPECIFIC COMMENTS

1 Executive Summary The summary should discuss the French drain The French drain alters the hydrology of much of the OU 1 area and also affects the pathways analysis

2 Section 2 3, p 2-8, first paragraph The discussion should include sites from OU 5 and OU 11 which are upstream of OU 1 These sites could affect both the surface water quality and sediment bedload contamination at the OU 1 sampling sites

3 Section 3 6 1, p 3 9, third paragraph The statement that "The Rocky Flats Alluvium is 10 to 20 feet thick and forms a uniform blanket-like deposit " is self-contradictory because the thickness is not uniform Please explain what "uniform" means in the sentence

4 Section 3 6 1, p 3 10, third paragraph The text states that the Rocky Flats Alluvium in Well 37591 is shown in cross section F-F' (Fig 3-16) In the figure, however, the extent of the RFA is not clear The contact between RFA and other units is not shown In the middle part of the cross section in the IHSS 119 1 area, "CL" deposits were shown as colluvium but the contact between CL and bedrock is shown as an alluvium/bedrock contact Please show the range of RFA in the cross section

5 Section 3 6 1 p 3-11, second paragraph The security fence has been used to describe locations, but the fence has not been shown on the maps or cross sections Please show the location of the fence on a map

6 Section 3 6 3, p 3 18, last paragraph Identification of seeps based on aerial photographs have been described The results from field verification of the images should be discussed because the field verification should be a part of the aerial photograph interpretation

7 Section 3 7 3 1, p 3 30, first paragraph This recharge area coincides with probable seeps recognized on 1951 aerial photographs (Fig 3 26) " The citation for the figure is incorrect and is probably Fig 3-25

8 Section 3 7 3 3, p 3 33, first paragraph The discussion in this paragraph should be clarified The second sentence which provides linear flow velocities also explains that the interpretation would indicate that there is no net flow An explanation of how the linear flow velocity was determined would help clarify this discussion

9 Section 3 7 3 7 p 3 37, first paragraph Effective porosity was estimated at 0 10 to 0 20 percent (1/10 of the estimated effective porosity for lateral flow calculations) This statement conflicts with the statement effective porosity is 10 20 percent in the first paragraph of this subsection If the effective porosity for lateral flow is 10 20%, then 1/10 of it should be 1 2% Please check the figures and subsequent calculations

10 Section 4 0, p 4-3, first paragraph The report should include a discussion of the results of the quality control data This appears to be an important point as all of media sampled show the potential for laboratory contamination

11 Section 4 0, p 4-4, first paragraph The statement that the common rock forming elements are not presented in soils maps is incorrect, these elements are presented on the maps Either delete this statement or modify the maps to show only those elements considered to be contaminants

12 Section 4 1, p 4 7, first paragraph The statistics for the soils data is not presented with Table 4 2 This information should be provided so a determination of the viability of the data set can be made

13 Section 4 1, p 4-7 second paragraph "In general, the data set for each surface soil constituent in the background data set was limited to 15 samples or less " It is unclear how many background surface soil samples were collected during the Phase III RFI/RI field investigation Please clarify and provide the sample locations

14 Section 4 2 7, p 4 28, fourth paragraph The statement on down-gradient does not appear to be meaningful, i e , it is not apparent that the selenium in the soils would be affected by any down-gradient forces Please explain or delete this statement

15 Section 4 3 p 4 32, third paragraph Please clarify how samples from the background area would be considered as having concentrations "above background " Please clarify whether this refers to samples that are statistical outliers Also, Table 4 2 information is only the 95 percent tolerance level the table should include the information referenced (i e , the summary statistics)

16 Section 4 3 1, p 4 33, first paragraph The information on Figs 4 79 and 4 80 suggests that Rock Creek may not have been an adequate background area, especially for radionuclides Given the small sample size at most only one sample should have been over the 95 percent tolerance level, however, the radionuclide information shows four and five samples over the level The data provided suggest that there may be two populations The assumption presented that Rock Creek is a valid background site, should be expanded

17 Section 4 3 2, p 4 34 second paragraph Lead also is at an elevated level sample RA032 has a lead level of 228 mg/kg

18 Section 4 5 1, p 4-39, third paragraph Total results should always be higher than, or the same as dissolved results If the results for the dissolved are higher, then there must have been some other factor affecting the results Please verify that the information is correct

19 Section 4 6 2, p 4 46, third paragraph Please provide any evidence of aquifer trauma," such as inability to stabilize the groundwater parameters, lack of sufficient water, etc that was encountered during well development or actual sampling

20 Section 4 8 1 2, p 4 59 second paragraph If possible, verify this possibility by examining any blank water samples taken from the carboy

21 Section 4 8 2 4, p 4 70, second paragraph It is unclear on what basis a factor of 10 can be used to determine whether the source of metals is natural or contaminants Please explain

22 Section 4 8 2 4 p 4 70 fourth paragraph It is unclear what constitutes bedrock fill materials Please clarify

23 Section 5 0 The discussion in this section appears to attribute the plutonium found in surface soil to dispersal from the 903 Pad It is likely that long term, low level releases from the Building 881 ventilation system is also responsible The text should provide the objective evidence that led to the conclusion that the plutonium's origin was the 903 Pad

24 Section 5 2 1 1 , p 5 13, first paragraph However, this average value is probably not representative due to the occurrence of isolated pockets of organic carbon " If so the values of the pockets should be averaged separately if possible

25 Section 5 2 1 1 Since the code WATEQ has been used widely for geochemical modeling in this section, it should be introduced briefly and its applicability should be discussed

26 Section 5 2 2 1, p 5 35, first paragraph Please explain the caution to be included in use of the distribution coefficient values

27 Section 5 3 1, p 5 50, first paragraph Please present the results of the analysis with supporting data i e , list the parameters involved and vulnerability index obtained

28 Section 5 3 1 2, p 5 57, second paragraph It is stated that evaluation of Fig 3 44 indicates the presence of a potential groundwater pathway to monitoring Well 6282 originating from the northeast, but Well 6286 is not shown in the figure Please add the well location to Fig 3 44

29 Figure 2 7 Please explain the purpose of the biased sampling locations shown on this figure The text does not discuss these samples If the sample population was examined as a whole the statistics would be affected by sampling in areas of known or suspected contamination

30 Figure 3 7 Please provide a legend showing the rock types represented by the patterns in the stratigraphic section

31 Figure 3 9 The surface map developed for the site-wide program indicated that there was more bedrock exposed than is shown here Please clarify whether any bedrock is exposed in the OU 1 area

32 Figure 3 18 This map should not include surficial unconsolidated material Also the contact between Recent Valley Fill and Laramie Formation does not agree with the contact on Fig 3 9

33 Figure 3 26 Stratigraphic position(s) of the rocks and soils shown in this cross section is unclear Please label the stratigraphic unit(s) in this figure

34 Figure 4 79 The data presented on this figure indicate that this sample population may not represent background conditions Americium and plutonium the prime concerns, both occur more often than they should The statistics for these samples should be presented Also the americium value presented on this figure and in Table 4 2 appear to disagree by a decimal place i e Table 4 2 has 0 2 the figure 0 02

35 Figure 4 84 This figure would be clearer if only the contaminants of concern (COCs) are shown The presence of such elements as aluminum calcium etc , obscures the important information

36 Table 4 1 The value for dissolved species in groundwater should not be greater than the total Please clarify whether the values are within the analytical error

37 Table 4 2 The americium value appears to be incorrect Please verify whether the value is 0 229 or 0 0229 The text indicates that this table is supposed to contain all the statistics for the background surface soil data This table contains none of that information Please provide the summary data

VOLUME XIII ENVIRONMENTAL EVALUATION

GENERAL COMMENTS

1 Serious disagreement exists in selection of COCs between the PHE and the EE In the PHE only organic compounds and radionuclides were selected as COCs and all metals were considered not to exceed background On the other hand, no organics were evaluated in the EE, and the only contaminants given consideration in the risk characterization were inorganic metals While it is expected that the COCs will vary between the two evaluations, it is unusual that they should be so completely different In the Phase III RFI/RI report, several figures indicate that semi volatile organic compounds were detected in the surface soils at several IHSSs within OU 1 For example, Fig 4 36 indicates AROCLOR 1248 at 7200 µg/kg and AROCLOR 1254 at 5200 µg/kg, as well as several polynuclear aromatic hydrocarbons (PAHs) in the 0-6 ft soil layer Also, Fig 4 44 indicates detection of several PAHs at 15 surface soil sampling sites within OU 1 It is recommended that organic contaminants be evaluated in the EE

SPECIFIC COMMENTS

1 Executive Summary, p xvi, second paragraph Please clarify why comparisons are made with background in both the first and second stages of screening of COCs

2 Executive Summary, p xvi third paragraph, fourth sentence There is no valid reason to assume that the Rocky Flats Plant (RFP) background is below the toxicity threshold for metals for the species present At least some of the species could be at the limit of their range of tolerance Thus a small increase in the metal concentrations could shift the species balance It is recommended that this sentence be deleted or better defended

3 Section E1 4 1, p E 3, List of designated IHSSs at OU 1 A figure should be included in the EE which shows the location of the IHSSs A brief description of the IHSSs and the nature of the contamination present would help the reader to understand the magnitude and nature of the problems present in OU 1

4 Section E2 2, p E 11, second paragraph Only 46% of the animal taxa are accounted for Please add missing species or correct the typographical error

5 Section E2 2 3 p E 13 Although reduction of the list of target species may be appropriate for OU 1, it may not be appropriate when the whole RFP area is considered If there are other contaminated OUs which adjoin OU 1 and might make up a larger portion of the home range of a larger mammal please identify Please indicate whether integrating the OU 1 EE into a site wide EE would affect the selection of target species

In addition, plant species are not included as potential target species even though they are evaluated in the ecological assessment Plants should be considered as potential target species

6 Section E2 2 4, p E 14 Several different categories of candidate species exist for listing on the endangered species list, and each category has a specific meaning Please specify what candidate category that the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is added to, and how that category is defined

7 Section E3 2 2, p E 16, second paragraph The roots of trees and shrubs often penetrate much deeper into the soil than expected Penetration of apple tree roots to a depth of 10 m (32 8 ft) has been documented (Kramer and Koslowski, 1979, *Physiology of Woody Plants*) Also, in semi arid regions phreatophytic plants that have root systems which penetrate to the groundwater are common (Billings 1970, *Plants Man, and the Ecosystem*) These plants have also been documented to have roots that penetrate to a depth of 10 m It is recommended that the possibility of plant roots penetrating to the deep groundwater be considered in the EE

8 Section E3 2 2 p E 16, second paragraph Please provide a better rationale for why inhalation pathways are excluded The justification for not considering air dispersal is weak First, inhalation of contaminated particulates may be more than episodic for burrowing mammals and other small mammals Second, the length of the animal's life is not relevant to whether it will be injured by inhalation of toxic substances Toxic doses are generally expressed and applied in terms of dose received per day It is recommended that the inhalation pathway be considered especially for the organic compounds that were reported in the surface soil

The second sentence of this paragraph includes fugitive dust as a primary release mechanism This inclusion appears to contradict the argument discussed above Please resolve this discrepancy

9 Section E3 3 1 p E 22, third paragraph A third criterion should be added for selecting a suitable reference site The area should be physically similar to the study site (i e it provides similar habitat) It is not possible to determine from this report whether this criterion is satisfied

10 Section E3 3 1 p E 23 second paragraph Please describe the criteria that would be used to reject the hypothesis that no adverse impact had occurred Please specify what level of species differences would be necessary to indicate that an adverse impact had occurred and describe what statistical test would be applied

11 Section E3 5 1 pp E 27 E 30 The procedure for selecting potential COCs should be fully explained This discussion of the procedure for screening chemicals as potential COCs is confusing First, it is unclear in which order the various criteria are evaluated The sequence of decisions should be explicitly stated Second it is unclear whether the selection process was performed at each of the sites or over the entire OU For example, a chemical is identified as being of concern if it was reported in at least 5% of the samples This could mean 5% of all OU samples or 5% of the samples at a particular site Please clarify these points of confusion

12 Section E3 5 1 p E 29, second paragraph The comparison with applicable or relevant and appropriate requirements (ARARs) and risk based levels in the extent of contamination step appears to repeat the ecotoxicity step Please clarify how these steps differ or remove the apparent redundancy in the evaluation process

13 Section E3 5 2 p E 30, last paragraph Please include a brief description of the procedure used in the Background Geochemical Characterization Report that was used to derive concentrations which describe background conditions for metals A quantitative description of the variation in background concentrations should be included in the report This description could be based on either confidence intervals or standard deviations with the number of samples included

14 Section E3 5 2 p E 31 first paragraph However no organic compounds were included in the COCs because organic contaminants were restricted to deep (greater that 15 feet) relatively immobile groundwater This statement is incorrect because several semi volatile organic contaminants including polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) were reported in the 0 6 ft layer in Figs 4 36 4 24 and 4 44 in the RFI/RI and similar compounds were reported in many surface soil samples in Fig 4 82 It is recommended that these compounds and the volatile organic compounds (VOCs) reported in Fig 4 96 be considered in the EE

15 Section E3 5 1, p E 31, fourth paragraph Please clarify how it was determined whether site concentrations exceeded two times background (i e whether means maxima or tolerance limits were compared) The adoption of <u>two times</u> background as a screen may be disagreed with It is argued that native organisms may be adapted to high natural levels of these metals Even if they are this does not mean that they are adapted to <u>two times</u> those levels

16 Section E3 8 p E 49 second paragraph Please provide a reference for the species richness test It is stated that Thirty percent is within the range of natural variability but no reference is given for the origin of that value

17 Table E4 1 2 The final reference value for As (6 8) seems low compared to the critical soil concentration range of 20 50 mg/kg for phytotoxicity given by Kabata Pendias and Pendias, 1984, Trace Elements in Plants The value for Cr (18 3) also seems low compared to the range of 75 100 from Kabata Pendias and Pendias The value for Zn is also at the low end of the range of 70 400 mg/kg from Kabata Pendias and Pendias Unless there are specific data indicating that the plant species found at OU 1 have a lower toxicity threshold for these metals then it is recommended that the values from Kabata Pendias and Pendias be used

18 E5 0, p E 77, second paragraph, third sentence This sentence should read The mean zinc concentration excluding the three highest values, was 71±15 mg/kg which is near the background level (61±13 mg/kg) " The same mistake was found in the Phase III RFI/RI report summary

References

Billings W D 1970 *Plants Man and the Ecosystem* Wadsworth Publishing Belmont CA

Kabata Pendias A and H Pendias 1984 *Trace Elements in Soils and Plants* CRC Press Boca Raton Florida

Kramer P J and T T Kozlowski 1979 *Physiology of Woody Plants* Academic Press New York

VOLUME XIV PUBLIC HEALTH EVALUATION

GENERAL COMMENTS

1 Examination of the spatial distribution of the groundwater data shows that contamination occurs in a few relatively small areas and that most monitoring wells are located outside these areas Surface soil contamination is more widespread but appears to be related to specific IHSSs OU wide frequencies of detection for individual compounds in soils are low Given these types of spatial distributions, several aspects of the risk assessment process that essentially average contaminant concentrations over the entire OU are inappropriate These aspects are discussed under specific comments on the relevant sections

2 The statistical procedure used to compare metals and radionuclide levels to background does not appear to be valid Up to five methods are applied in sequence to the data F test, Bartletts test, mean rank sum comparisons Mann Whitney and comparison to regional ranges The procedure used is unclear and is described differently in PHE text and Attachment F1, however the methods seem to be applied sequentially until one of them shows site data to be below background at which time the procedure ends regardless of the relative appropriateness or the results of other tests The F test and Bartletts test measure only equivalence of variance between two sample sets (on site and background) To argue

that two sample sets come from the same population one would need at least to test for equivalence of means in addition Strictly speaking these tests are appropriate only for normally distributed data which most of the current data are not Use of a simple comparison of mean rank sums to argue that the site concentrations are below background concentrations has no statistical basis The Mann Whitney test is the most appropriate test, but it is applied only when the site data fail the other less appropriate tests When site data fail even the Mann Whitney test they are simply compared to regional ranges

SPECIFIC COMMENTS

1 Section F2 1 p F2 1, second paragraph This paragraph states that 53% of the laboratory data have been validated, while the more detailed discussion in Attachment F1 2 implies that all data have been validated Please clarify the situation with respect to data validation and discuss whether invalidated data were used in the risk assessment

2 Section F2 1 p F2 2, first paragraph It seems unlikely that OU 1 soil data would be useful for surface water and sediment risk assessment Please clarify

3 Section F2 1 p F2 2 second paragraph Limiting subsurface soil COCs to those that are also COCs in surface soils seems inappropriate because subsurface sources of contamination appear to exist e g a burial pit and a sanitary waste line Please clarify

4 Section F2 2 2 p F2 4 fourth paragraph Given the spatial distribution of data (see General Comment 1), applying a frequency of detection screen for COCs is inappropriate doing so can potentially eliminate important but not widely distributed contaminants It is recommended that this step be dropped from the analysis

5 Section F2 2 3 p F2 5 second paragraph No description is given of the actual methodology used to screen for hot spots either here or in the referenced Attachment F1, both the thing compared to and the comparison levels are given only as examples In any case given the spatial distribution of the data described in the previous comment there is no real basis for any comparison to a central tendency of all the OU 1 data Inspection of the mapped concentration data seems to be as defensible and a simpler method of delineating hot spots If the frequency of detection screen is eliminated (see previous comment), there is no need for this step It is recommended that this step be dropped also If that is not done, a better definition and defense of the methodology are needed

6 Section F2 2 4 p F2 5 The description of the statistical methodology given here is different from that presented in Attachment F1 The overall procedure does not appear to be valid, see General Comment 2

7 Given the spatial distribution observed in the organic data in both soils and groundwater averaging over the entire OU 1 soil and groundwater data sets to characterize metals and radionuclide contamination is inappropriate That procedure would tend to underestimate site specific concentrations seriously

8 Section F2 2 4 p F2 5, third paragraph The statement that no organic compounds were detected in surface soils is incorrect Please correct

9 Section F2 2 4 p F2 6 first paragraph The F test is a test for the equality of variances not means Please correct

10 Section F2 2 4 p F2 7 first paragraph Metals concentrations vary widely by region and soil type and an explanation is needed of why the literature derived values for metals concentrations in soils are appropriate for this OU If the ultimate criteria for acceptable metals concentration in soils are to be literature values, the detailed statistical analysis would seem superfluous Please discuss these issues

11 Section F2 2 5 p F2 7, second paragraph Effective use of toxicity screens requires that appropriate exposure pathways are considered and that the appropriate toxicity factors are available For groundwater for example inhalation is the only exposure pathway considered in the risk assessment and typically few inhalation toxicity factors are available making it questionable whether groundwater contaminants could be effectively screened Please discuss the screening methodology and results in more detail

12 Section F2 2 6 p F2 8, second paragraph In the first sentence, it does not follow that a compound is a transformation product because it is mobile or soluble Please revise In addition it is unclear why a compound should be retained in the analysis because it is a transformation product if it had been shown not to contribute to risk Please clarify

13 Section F3 5 2 1 1, p F3 27 The derivation of the soil gas model equations is difficult to follow Major steps seem to have been left out It is recommended that this section contain only a brief verbal description of the model, especially since this material is repeated verbatim in Attachment F 3

14 Section F3 5 2 1 2, p F3 32 first paragraph Given the spatial distribution of the groundwater contamination it is inappropriate to estimate exposure point concentrations by methods that essentially average all the concentration data for OU 1 Such averages are not meaningful and may seriously underestimate potential exposure For example the groundwater concentrations presented in Table F3 3 are orders of magnitude below measured concentration in the 119 1 area for several compounds The treatment of non detects appears to be exactly opposite to that recommended in *Statistical Analysis of Ground Water Monitoring data at RCRA Facilities* (USEPA 1989) Please explain

15 Section F3 5 2 1 2 p F3 32 Table F3 3 Are the numbers presented for groundwater concentrations the logs of the geometric means? Please clarify

16 Section F3 5 2 1 2, p F3 36 second paragraph The relevance of the assumption about soils beneath the structures is unclear since the model does not address soils Please clarify

17 Section F5 p F5 2 Table F5 1 This table should include the following comment as an uncertainty for the future on site resident 1) The assumption that all produce ingested by humans is from the above ground portions of the plant and never from the roots

18 Section F5, p F5 2 Table F5 1 There are major uncertainties associated with exposure point concentrations estimated from the soil gas and air modeling as well as uncertainties associated with food chain calculations These uncertainties should be added to this table

19 Section F6 5 p 6 23 Table F6 6 This table and the associated text introduce the results of risk calculations for hot spots and clean areas without previous indication that these calculations were done The comparisons presented in the table are quite useful It is recommended that they be introduced in Sect 3 with full explanation of the differences among the calculations

Attachment F 1

GENERAL COMMENT

Some of the backup material included in this attachment appears to be inconsistent with Sect 3 of the PHE and with the text of the attachment For example tests for normality are presented and results seem to be given but are not mentioned in the main text In addition the results presented seem to indicate that ANOVA was conducted, but this procedure in never mentioned in the text Please clarify